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ABSTRACT

Gumpgookies, an objective-projective test of school achievement motivation for children 3 1/2 to 8 year, was reduced from 100 to 75 items following extensive factor analyses. This revised test attempted to dissipate the effects of response sets of the subjects and was prepared in three versions--an individual form, a group form for non-readers, and a group form for readers. However, the problem of response sets remained, and therefore a factor analytic procedure was devised to partial response sets out of an item intercorrelation matrix, resulting in a program that yielded orthogonal factors that are completely uncorrelated with the response set scores. (Author/MS)

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A New Approach To Response Sets in Analysis of a Test of Motivation To Achieve*

A Section of the Final Report for 1969-70

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A NEW APPROACH TO RESPONSE SETS IN ANALYSIS OF A TEST OF MOTIVATION TO ACHIEVE*

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Gumpgookies is an objective-projective test of motivation to achieve in school, intended for children in an age range of three and a half to eight or possibly nine. Each item consists of a description of two imaginary figures called gumpgookies, and the task of the child is to indicate with which gumpgookie he identifies.

For example:

These gumpgookies should be working.

This one is watching.

This one is working.

The first form of the test consisted of 100 items in which illustrations of Gumpgookies were presented in left-hand or right-hand positions and in which the left-hand figure was always described first.

Factor analyses of data from this first form yielded factors which, although suggestive of substantive interpretations, seemed to be influenced by the positions of the answers and/or primacy versus recency, i.e., whether the keyed answer was presented first or last. Thus some factors were loaded for items with answers predominantly in the right-hand position, some for items with answers predominantly in the left-hand position. And some factors tended to be loaded for items with answers presented first, others for items with answers presented last.

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In an effort to dissipate the effects of these response sets of the subjects, a new format was devised, whereby the alternatives were presented in varying positions--up and down, left and right, upper left and lower right, and upper right and lower left. At the same time, the order in which the alternatives were presented by the examiner was randomized. The number of items was reduced from 100 to 75, and most of the alternatives were revised to reduce their cognitive or verbal difficulty. This test was prepared in three versions, an individual form, a group form for non-readers, and a group form for readers.

A previous report to the Office of Economic Opportunity, available through ERIC, described a number of factor analyses of data on these forms of the Gumpgookies test that had been completed by November, 1969 (Adkins, Ballif, 1970a). Although the results were interpreted in terms of substantive factors, the interpretations were still clouded by the troublesome influence of two main types of extraneous influences or response sets: the effects of the positions of the answers to the items and the influence of the order in which the keyed answer is presented. A later publication presents the hypotheses on which the test is based and discusses their relation to empirically determined factors for the test in randomized format (Adkins and Ballif, 1970b).

In retrospect, it appears that the effort to get rid of the effects of response sets by means of revising the format were not successful. Extraneous influences were still in evidence and had only become somewhat more difficult to detect. Parenthetically, it should be noted that these response sets have no systematic undesirable influence on total score on the test, because the subject is expected to get only a chance score on items to which he responds on the basis of a particular set. But the response sets do affect the items that are loaded on particular factors, so

that a subject could get unwarrantedly high or low scores on the separate factors. Moreover, the effects of response sets on the composition of the factors made their interpretations very tenuous.

Since, disappointingly, the change in format had not been successful, another type of solution to the response set problem had to be found before factors could be interpreted with any assurance. The next approach that was pursued was based on the idea of computing response set scores for each subject, partialling these out of the item intercorrelation matrix, and factoring the resulting matrix. Hence for each subject were computed the number of answers he chose that were in the left-hand position, the number of answers he chose that were in the up position, and the number of answers he chose that had been presented first. In the case of the items in which alternatives had been placed in a diagonal position, e.g., upper left and lower right, an arbitrary decision was made to regard upper left and upper right as up, lower left and lower right as down. This was done because the small numbers of items involved in the two diagonal positions would have resulted in response set scores of very low reliability for these positions.

The problem of developing the mathematical solution for partialling these three variables out of an item intercorrelation matrix was presented to Dr. Paul Horst, whose technical report will appear later. The details of the computer program to effect the solution were worked out by Renato Espinosa and Robert Bloedon, members of the Hawaii Center staff, with the guidance of Dr. Horst. The result is a program that yields orthogonal factors that are completely uncorrelated with the response set scores.

The complete program includes routines that provide, among other things, the correlations of each item with the response set scores, the rotated "partial" factor loadings for each item, and reliability estimates (KR-20)

for each partial factor as well as for the response set scores. It prints, for each item for each partial factor, approximate integral weights of -1, 0, 1 that could be used in hand scoring to yield approximate factor scores. A weight of -1 for an item indicates that it is functioning as a suppressor variable. The program also yields exact factor scores for each subject, based upon regression weights for each item. The approximate factor scores correlate in the neighborhood of .90 with the exact scores. It should be understood that, for any group of subjects sufficiently large to warrant a factor analysis, exact factor scores would be used if separate factor scores are desired. However, if a factor analysis resulting in approximate integral weights is available for a large sample and an investigator has only a small sample of the same kind of subject, the solution of approximate factor scores by means of the integral weights might be serviceable. These could be obtained by hand scoring.

For the first factor analyses that had been run on the earliest form of the test, the number of factors was not specified, and it was naively supposed that the computations should be continued until the eigenvalue dropped below unity. It was found, however, that this had not occurred even when some forty factors had been extracted. It was clear that each of such a large number of factors would be determined primarily by so few items as to make their interpretation impossible. Moreover, because of the theoretical basis of the test, it was thought that probably no more than five or at most six factors would be interpretable. Hence the later analyses are largely confined to five factors, although some solutions with three, four, six, and eight factors were obtained.

Separate analyses were made for 1813 four-year-old children, for 128 first-graders, for 122 second-graders, for 250 first- and second-graders

combined, and finally for a total group of 2313 children. Not surprisingly, the KR-20 values for the partial factors tended to be higher for the older children. It should also be mentioned that for all groups the KR-20 values for the partial factors tended to be less than for the factors based on the zero-order correlation matrix. This is doubtless true because the latter factors include reliable effects of response sets. Response set scores were more consistent for the older children. It was also interesting to find that factors for the older children showed relatively more influence of a primacy-recency set, those for the younger children more influence of answer position sets, as indicated by correlations of response set scores both with individual items and with "unpartial" factor scores.

Details of the extensive work that was done in comparing the several solutions for different numbers of factors and for different groups, as well as in comparing partial factors and unpartial factors, will not be presented here. They would only overwhelm the reader, as indeed they often threatened to do with the investigators. It had soon become apparent, with respect to both the original unpartial factors and the partial factors, that those for the four-year-olds did not correspond to those for the first- and second-graders as closely as had been expected. It was not unreasonable to suppose, however, that the factorial composition of motivation to achieve in school changes with age. Indeed, such is almost certainly the case. Yet, despite the conviction that changes with age in the factors affecting the test responses were to be expected, attempts to interpret the changes were not highly successful.

Full exploration of this problem led to question as to the dependability of factor loadings obtained from phi coefficients based upon relatively small numbers of cases. Although the general plan of the investigations

that have been done was to have at least 200 cases for any factor analysis, it seemed possible that this number was too small. Hence a plan was devised whereby routinely each sample was divided at random into halves and separate factor analyses were made for each half as well as for the total sample. Then the general plan was to investigate the similarity of the three sets of factor loadings for each sample by inspecting the correlations of the loadings from the three solutions, i.e., for the two half samples and for the total sample. In this approach, a factor for the total sample was regarded as verified when a factor in one half sample and a factor in the other half sample each shows its highest correlation for the same factor in the total sample at the same time that these same factors for the half samples have the highest correlation of any pair of factors across the half samples. Thus factor 2 for the first half sample might correlate .85 with factor 3 for the total; factor 3 for the second half sample might correlate .77 with factor 3 for the total; and factor 2 for the first half sample might correlate .73 with factor 3 for the second half sample. If these were the highest of the correlations inspected for these factors, the factor for the total sample would be regarded as verified.

Results of a number of applications of this approach are presented in Tables 1, 2, 4, 5, 7, 8, 10, 11 and 14. The other tables show further comparisons among different factor analyses.

Detailed inspection of these tables has led to the conclusion that the most defensible interpretation of factors results from the five-factor analysis based upon a group of 2313 cases, including 2063 four-year-olds and 250 first- and second-graders. The five factors for this total group were verified more clearly than for any other subsample. Hence the interpretation of factors that can be offered now will be based upon this analysis for the

total sample. At this stage, however, it will have become apparent that interpretations of factors gleaned from responses of young children to dichotomous items of the type in question are tenuous at best and must be based upon very large numbers of children.

Although the KR-20 estimates of reliability for the total test score on Gumpgookies have been in the neighborhood of .85 to .90, the estimated reliabilities, as determined by KR-20 coefficients, for the five factors of course are not so high, ranging from .35 to .55 for the large combined sample. This is not surprising, since the total test consists of only 75 items. An indicated next step, if any particular factor is to be explored more fully, will be to increase the number of items contributing strongly to that factor and have a single test for it. With an increase in number of items per factor, the factor score reliabilities may be expected to increase.

For the interpretation of factors, once they have been verified by the method described above, the method has been first to list for a factor the items that have their highest loading on it for the total sample. Then the loading of that item for the corresponding factor in each half sample is recorded, with a notation as to whether it is the highest loading for the item. Greatest weight is accorded those items for which there is verification in all three analyses, i.e., for which the highest loadings apply to the appropriate verified factors. Attention is also given to the size of loadings, those of about .30 or above tending to be associated with greater verifiability than those below .30.

In the discussion that follows, the factor numbers in parentheses following the letter designations refer to the numbers for the total group analysis and the two half-group analyses in Table 14.

Factor A (11, 1, 6) consists of items indicating an autonomous activity orientation permeating the use of time and interaction with others. This on-the-go behavior is more than generalized activity; it is initiating and engaging in specific behavior that is always appropriate to insure success in the particular tasks and situations at hand. It involves both knowing the effective instrumental steps and taking them. These activities are instrumental to achievement in general, e.g., wanting to work longer; to achievement in school, e.g., keeps trying to write numbers; as well as to obtaining reinforcement for achievement, e.g., shows its paintings to others. Perhaps this interpretation can also include ways of thinking--attitudes about school as instrumental covert behavior for success in school. If so, the few items suggesting that school and learning are liked are still consistent within this framework. In any case, the factor consists of thinking of and doing those appropriate activities that are instrumental to achievement. It might appropriately be named instrumental activity.

The reflection of a preference for school- and teacher-related experiences is clear in factor B (12, 2, 9). The specific items include wanting to go to school to learn and liking learning along with watching and helping the teacher as opposed to playing or engaging in other activities. This positive attitude toward school is further exhibited by an identification with the teacher, e.g., wanting to be the teacher when playing school. Factor B, then, appears to be a school enjoyment factor. Because items dealing with work-like activities in non-school activities were only sparsely represented in the total test, however, the possibility that the factor would be better described as work enjoyment has not been ruled out.

The items constituting factor C (13, 5, 8) represent the ability to evaluate one's own performance coupled with the confidence that the evaluation will be high. The process of self-evaluation is suggested by items

portraying gumpgookies who know when their work is right, when they are doing well in school, what they can and cannot do, and whether or not they are always doing their best. Items describing gumpgookies who are self-evaluated as always at their best and doing well also suggest an awareness of their own excellence. Perhaps this factor can be considered an evaluative factor.

Factor D (14, 4, 10) consists almost entirely of tiems set in competitive physical situations, e.g., winning in running, climbing higher, and leading in follow the leader. Apparently it represents self-confidence in coming out on top, in being the best or better than the next one. With additional items staged in other settings, it seems likely that the factor would transcend physical activities.

The common denominator for items loading on factor E (15, 3, 7) has to do with an awareness of implications of present behavior for the future--perhaps even more specifically for accomplishment of a future goal. The gumpgookies in these items are still trying to obtain their future goals, e.g., trying to write. They are apparently directed by their own self-initiated purposes. This, then, appears to be some type of purposive factor. The need for further verification of this interpretation with additional items or through experimental work is evident.

TABLE 1

Correlations Among Loadings on Five Factors Based on Zero-Order Correlations for the First Half, Second Half, and Total Sample of 250 Hawaiian Children in Grades 1 and 2

	First Half					Second Half					Total				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1.00	-.16	-.03	-.10	-.03	.40	.21	.03	-.27	-.03	.62	.44	-.06	-.04	-.21
2	-.16	1.00	-.05	-.10	-.21	-.09	-.12	.04	-.01	.22	-.23	-.07	.57	-.10	.20
3	-.03	-.05	1.00	-.05	-.06	.21	-.05	.15	-.09	.17	.33	-.36	.46	.00	-.40
4	-.10	-.10	-.05	1.00	-.08	.11	-.17	.02	.18	.09	.19	-.29	-.08	.13	.51
5	-.03	-.21	-.06	-.08	1.00	.07	-.22	.38	.08	-.06	.07	-.16	-.27	.78	-.23
6	.40	-.09	.21	.1	.07	1.00	-.08	-.14	-.17	-.08	.89	-.12	-.11	-.15	-.19
7	.21	-.12	-.05	-.17	-.22	-.08	1.00	-.16	-.20	-.06	.00	.81	.04	-.31	-.21
8	.03	.04	.15	.02	.38	-.14	-.16	1.00	-.17	-.06	-.05	-.15	.21	.73	-.37
9	-.27	-.01	-.09	.18	.08	-.17	-.20	-.17	1.00	-.10	-.14	-.29	-.22	.21	.62
10	-.03	.22	.17	.09	-.06	-.08	-.06	-.06	-.10	1.00	-.09	-.14	.70	-.08	.09
11	.62	-.23	.33	.19	.07	.89	.00	-.05	-.14	-.09	1.00	-.10	-.12	-.08	-.22
12	.44	-.07	-.36	-.29	-.16	-.12	.81	-.15	-.29	-.14	-.10	1.00	-.11	-.22	-.18
13	-.06	.57	.46	-.08	-.27	-.11	.04	.21	-.22	.70	-.12	-.11	1.00	-.13	-.10
14	-.04	-.10	.00	.13	.78	-.15	-.31	.73	.21	-.08	-.08	-.22	-.13	1.00	-.16
15	-.21	.20	-.40	.51	-.23	-.19	-.21	-.37	.62	.09	-.22	-.18	-.10	-.16	1.00

TABLE 2

Correlations Among Loadings on Five Partialled Factors for the
First Half, Second Half, and Total Sample of 250 Hawaiian Children in Grades 1 and 2

	First Half					Second Half					Total				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1.00	-.07	-.09	-.07	-.06	.42	-.22	.20	.05	-.02	.76	.32	-.08	.02	-.16
2	-.07	1.00	-.05	-.01	-.08	.15	.27	-.18	-.13	.03	.04	-.29	.01	.69	-.02
3	-.09	-.05	1.00	-.11	-.05	.29	-.05	-.14	.06	.13	.17	-.36	-.15	-.14	.80
4	-.07	-.01	-.11	1.00	-.10	-.03	-.08	-.17	.21	.18	-.09	-.03	.49	-.01	.14
5	-.06	-.08	-.05	-.10	1.00	-.06	-.02	.00	.22	.18	-.06	.02	.57	-.04	-.01
6	.42	.15	.29	-.03	-.06	1.00	-.12	-.06	-.13	-.09	.81	-.16	-.25	.13	.23
7	-.22	.27	-.05	-.08	-.02	-.12	1.00	-.13	-.22	-.12	-.28	-.15	-.02	.67	-.08
8	.20	-.18	-.14	-.17	.00	-.06	-.13	1.00	-.15	-.11	.01	.86	-.35	-.12	.05
9	.05	-.13	.06	.21	.22	-.13	-.22	-.15	1.00	-.17	.07	-.16	.62	-.35	.04
10	-.02	.03	.13	.18	.18	-.09	-.12	-.11	-.17	1.00	-.18	-.05	.27	.17	.37
11	.76	.04	.17	-.09	-.06	.81	-.28	.01	.07	-.18	1.00	-.05	-.19	-.02	-.02
12	.32	-.29	-.36	-.03	.02	-.16	-.15	.86	-.16	-.05	-.05	1.00	-.20	-.17	-.11
13	-.08	.01	-.15	.49	.57	-.25	-.02	-.35	.62	.27	-.19	-.20	1.00	-.08	-.07
14	.02	.69	-.14	-.01	-.04	.13	.67	-.12	-.35	.17	-.02	-.17	-.08	1.00	-.08
15	-.16	-.02	.80	.14	-.01	.23	-.08	.05	.04	.37	-.02	-.11	-.07	-.08	1.00

TABLE 3

Correlations Among Loadings of Five Factors Based on the Third-Order Partial Correlation Matrix and on the Zero-Order Correlation Matrix for 250 Hawaiian Children in Grades 1 and 2

	Third-Order Partial					Zero-Order				
	1	2	3	4	5	6	7	8	9	10
1	1.00	-.05	-.19	-.02	-.02	.88	.03	.06	-.14	-.36
2	-.05	1.00	-.20	-.17	-.11	-.12	.95	-.10	-.17	-.17
3	-.19	-.20	1.00	-.08	-.07	-.40	-.23	.44	.50	.11
4	-.02	-.17	-.08	1.00	-.08	.20	-.30	.00	-.07	.72
5	-.02	-.11	-.07	-.08	1.00	.16	-.20	.53	.16	-.40
6	.88	-.12	-.40	.20	.16	1.00	-.10	-.12	-.08	-.22
7	.03	.95	-.23	-.30	-.20	-.10	1.00	-.11	-.22	-.18
8	.06	-.10	.44	.00	.53	-.12	-.11	1.00	-.13	-.10
9	-.14	-.17	.50	-.07	.16	-.08	-.22	-.13	1.00	-.16
10	-.36	-.17	.11	.72	-.40	-.22	-.18	-.10	-.16	1.00

TABLE 4

Correlations Among Loadings on Four Factors Based on Zero-Order Correlations for the First Half, Second Half, and Total Sample of 250 Hawaiian Children in Grades 1 and 2

	First Half				Second Half				Total			
	1	2	3	4	5	6	7	8	9	10	11	12
1	1.00	-.17	-.05	-.12	.35	.14	.13	-.25	.54	.41	-.36	.21
2	-.17	1.00	-.07	-.12	-.02	.01	.00	-.02	-.06	.07	.66	-.32
3	-.05	-.07	1.00	-.08	.23	-.04	.26	-.07	.36	-.15	.04	.14
4	-.12	-.12	-.08	1.00	.10	-.22	.14	.22	.20	-.45	.16	.31
5	.35	-.02	.23	.10	1.00	-.08	-.15	-.16	.89	-.10	-.27	-.17
6	.14	.01	-.04	-.22	-.08	1.00	-.19	-.23	-.01	.81	.00	-.31
7	.13	.00	.26	.14	-.15	-.19	1.00	-.19	-.04	-.08	.11	.71
8	-.25	-.02	-.07	.22	-.16	-.23	-.19	1.00	-.14	-.46	.33	.16
9	.54	-.06	.36	.20	.89	-.01	-.04	-.14	1.00	-.08	-.25	-.09
10	.41	.07	-.15	-.45	-.10	.81	-.08	-.46	-.08	1.00	-.17	-.19
11	-.36	.66	.04	.16	-.27	.00	.11	.33	-.25	-.17	1.00	-.20
12	.21	-.32	.14	.31	-.17	-.31	.71	.16	-.09	-.19	-.20	1.00

TABLE 5

Correlations Among Loadings on Four Partialled Factors for the
First Half, Second Half, and Total Sample of 250 Hawaiian Children in Grades 1 and 2

	First Half				Second Half				Total			
	1	2	3	4	5	6	7	8	9	10	11	12
1	1.00	-.14	-.09	-.11	.47	-.10	-.02	-.01	.59	.29	-.16	.12
2	-.14	1.00	-.13	-.11	.08	.25	-.09	-.16	.06	-.33	-.05	.48
3	-.09	-.13	1.00	-.15	.24	-.10	-.14	.12	.47	-.32	.16	-.41
4	-.11	-.11	-.15	1.00	-.14	-.03	-.06	.12	-.22	-.08	.75	-.04
5	.47	.08	.24	-.14	1.00	.00	-.16	-.09	.82	.05	-.23	.05
6	-.10	.25	-.10	-.03	.00	1.00	-.19	-.15	-.22	-.12	.09	.60
7	-.02	-.09	-.14	-.06	-.16	-.19	1.00	-.17	-.11	.66	-.14	-.21
8	-.01	-.16	.12	.12	-.09	-.15	-.17	1.00	.02	-.03	.26	-.26
9	.59	.06	.47	-.22	.82	-.22	-.11	.02	1.00	-.08	-.24	-.13
10	.29	-.33	-.32	-.08	.05	-.12	.66	-.03	-.08	1.00	-.26	-.20
11	-.16	-.05	.16	.75	-.23	.09	-.14	.26	-.24	-.26	1.00	-.21
12	.12	.48	-.41	-.04	.05	.60	-.21	-.26	-.13	-.20	-.21	1.00

TABLE 6

Correlations Among Factor Loadings of Four Factors Based on the Third-Order Partial Correlation Matrix and on the Zero-Order Correlation Matrix for 250 Hawaiian Children in Grades 1 and 2

	Third-Order Partial				Zero-Order			
	1	2	3	4	5	6	7	8
1	1.00	-.08	-.24	-.13	.90	.05	-.10	-.04
2	-.08	1.00	-.26	-.20	-.03	.91	-.33	-.20
3	-.24	-.26	1.00	-.21	-.46	-.09	.55	.53
4	-.13	-.20	-.21	1.00	.20	-.47	.30	-.10
5	.90	-.03	-.46	.20	1.00	-.08	-.25	-.09
6	.05	.91	-.09	-.47	-.08	1.00	-.17	-.19
7	-.10	-.33	.55	.30	-.25	-.17	1.00	-.20
8	-.04	-.20	.53	-.10	-.09	-.19	-.20	1.00

TABLE 7

Correlations Among Loadings on Five Factors Based on Zero-Order Correlations for the First Half, Second Half, and Total Sample of 1813 Head Start Children

	First Half					Second Half					Total				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1.00	-.26	-.07	-.36	-.20	.76	-.53	-.18	.26	.05	.84	-.48	-.26	.01	-.16
2	-.26	1.00	-.17	-.02	-.03	-.38	.45	-.30	-.04	-.28	-.36	.67	-.40	-.05	.31
3	-.07	-.17	1.00	-.07	-.01	.06	.10	.57	-.33	.26	-.07	-.09	.81	-.27	.06
4	-.36	-.02	-.07	1.00	-.03	-.12	.47	.21	-.10	-.40	-.26	.01	.08	-.02	.74
5	-.20	-.03	-.01	-.03	1.00	-.46	.19	.25	.48	-.23	-.46	.03	.07	.76	.08
6	.76	-.38	.06	-.12	-.46	1.00	-.39	-.16	-.04	.12	.91	-.43	-.04	-.34	-.11
7	-.53	.45	.10	.47	.19	-.39	1.00	-.17	-.07	-.29	-.54	.62	-.03	-.04	.65
8	-.18	-.30	.57	.21	.25	-.16	-.17	1.00	-.19	-.09	-.29	-.48	.79	.12	.17
9	.26	-.04	-.33	-.10	.48	-.04	-.07	-.19	1.00	-.08	.15	-.11	-.37	.85	-.08
10	.05	-.28	.26	-.40	-.23	.12	-.29	-.09	-.08	1.00	.29	.02	.34	-.16	-.68
11	.84	-.36	-.07	-.26	-.46	.91	-.54	-.29	.15	.29	1.00	-.37	-.21	-.16	-.31
12	-.48	.67	-.09	.01	.03	-.43	.62	-.48	-.11	.02	-.37	1.00	-.29	-.11	.04
13	-.23	-.40	.81	.08	.07	-.04	-.03	.79	-.37	.34	-.21	-.29	1.00	-.20	-.06
14	.01	-.05	-.27	-.02	.76	-.34	-.04	.12	.85	-.16	-.16	-.11	-.20	1.00	-.03
15	-.16	.31	.06	.74	.08	-.11	.65	.17	-.08	-.68	-.31	.04	-.06	-.03	1.00

TABLE 8

Correlations Among Loadings on Five Partialled Factors for the First Half, Second Half, and Total Sample of 1813 Head Start Children

	First Half					Second Half					Total				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1.00	-.20	-.16	-.11	-.21	.73	-.23	.11	-.10	-.30	.83	-.15	-.27	.17	-.32
2	-.20	1.00	-.24	-.13	-.18	-.08	.47	-.01	.05	.09	-.05	.00	.75	-.08	-.26
3	-.16	-.24	1.00	-.19	-.21	.02	-.42	.32	-.17	.34	-.01	-.39	-.31	.47	.59
4	-.11	-.13	-.19	1.00	-.13	.10	.15	-.55	.45	-.02	.03	.73	-.23	-.59	.19
5	-.21	-.18	-.21	-.13	1.00	-.30	.35	.03	-.04	-.07	-.43	.10	.33	-.04	.01
6	.73	-.08	.02	.10	-.30	1.00	-.12	-.16	-.22	-.26	.95	-.19	-.18	-.13	-.15
7	-.23	.47	-.42	.15	.35	-.12	1.00	-.14	-.08	-.13	-.15	.22	.80	-.40	-.24
8	.11	-.01	.32	-.55	.03	-.16	-.14	1.00	-.22	-.20	-.16	-.34	.02	.87	-.18
9	-.10	.05	-.17	.45	-.04	-.22	-.08	-.22	1.00	-.25	-.16	.81	-.22	-.02	-.14
10	-.30	.09	.34	-.02	-.07	-.26	-.13	-.20	-.25	1.00	-.21	-.32	.13	-.19	.78
11	.82	-.05	-.01	.13	-.43	.95	-.15	-.16	-.16	-.21	1.00	-.17	-.20	-.13	-.16
12	-.15	.00	-.39	.73	.10	-.19	.22	-.34	.81	-.32	-.17	1.00	-.15	-.26	-.22
13	-.27	.75	-.31	-.23	.33	-.18	.80	.02	-.22	.13	-.20	-.15	1.00	-.21	-.18
14	.17	-.08	.47	-.59	-.04	-.13	-.40	.87	-.02	-.19	-.13	-.26	-.21	1.00	-.18
15	-.32	-.26	.59	.19	.01	-.15	-.24	-.18	-.14	.78	-.16	-.22	-.18	-.18	1.00

TABLE 9

Correlations Among Loadings on Five Factors Based on the Third-Order Partial Correlation Matrix and on the Zero-Order Correlation Matrix for 1813 Head Start Children

	Third-Order Partial					Zero-Order				
	1	2	3	4	5	6	7	8	9	10
1	1.00	-.17	-.20	-.13	-.16	.27	-.41	.00	.72	.07
2	-.17	1.00	-.15	-.26	-.22	.21	-.12	-.25	-.35	.65
3	-.20	-.15	1.00	-.21	-.18	.10	.54	-.05	-.40	.03
4	-.13	-.26	-.21	1.00	-.18	-.05	-.01	.27	.21	-.46
5	-.16	-.22	-.18	-.18	1.00	-.05	.23	.16	-.08	-.34
6	.27	.21	.10	-.05	-.05	1.00	-.37	-.21	-.16	-.31
7	-.41	-.12	.54	-.01	.23	-.37	1.00	-.29	-.11	.04
8	.00	-.25	-.05	.27	.16	-.21	-.29	1.00	-.20	-.06
9	.72	-.35	-.40	.21	-.08	-.16	-.11	-.20	1.00	-.03
10	.07	.65	.03	-.46	-.34	-.31	.04	-.06	-.03	1.00

TABLE 10

Correlations Among Loadings on Four Factors Based on Zero-Order Correlations for the First Half, Second Half, and Total Sample of 1813 Head Start Children

	First Half				Second Half				Total			
	1	2	3	4	5	6	7	8	9	10	11	12
1	1.00	-.37	-.10	-.03	.77	-.65	-.24	.34	.85	-.54	-.23	.23
2	-.37	1.00	-.03	-.35	-.64	.41	-.10	.33	-.59	.36	-.17	.46
3	-.10	-.03	1.00	-.21	.09	-.06	.71	-.22	-.04	-.10	.82	-.16
4	-.03	-.35	-.21	1.00	.28	-.17	-.05	-.14	.23	-.23	.03	-.12
5	.77	-.64	.09	.28	1.00	-.50	-.13	-.12	.93	-.41	.00	-.22
6	-.65	.41	-.06	-.17	-.50	1.00	-.20	-.16	-.53	.93	-.13	-.10
7	-.24	-.10	.71	-.05	-.13	-.20	1.00	-.21	-.25	-.25	.92	-.11
8	.34	.33	-.22	-.14	-.12	-.16	-.21	1.00	.09	-.14	-.34	.89
9	.85	-.59	-.04	.23	.93	-.53	-.25	.09	1.00	-.47	-.21	-.11
10	-.54	.36	-.10	-.23	-.41	.93	-.25	-.14	-.47	1.00	-.14	-.08
11	-.23	-.17	.82	.03	.00	-.13	.92	-.34	-.21	-.14	1.00	-.17
12	.23	.46	-.16	-.12	-.22	-.10	-.11	.89	-.11	-.08	-.17	1.00

TABLE 11

Correlations Among Loadings on Four Partialled Factors for the First Half, Second Half, and Total Sample of 1813 Head Start Children

	First Half				Second Half				Total			
	1	2	3	4	5	6	7	8	9	10	11	12
1	1.00	-.27	-.27	-.22	.63	-.15	-.33	.24	.76	.31	-.39	-.24
2	-.27	1.00	-.24	-.15	-.14	.58	-.06	-.07	-.22	.04	.68	-.21
3	-.27	-.24	1.00	-.26	.18	-.36	.62	-.37	.16	-.65	-.07	.74
4	-.22	-.15	-.26	1.00	-.35	.29	-.28	.31	-.39	.51	.16	-.28
5	.63	-.14	.18	-.35	1.00	-.19	-.25	-.26	.94	-.20	-.27	-.15
6	-.15	.58	-.36	.29	-.19	1.00	-.24	-.15	-.21	.17	.80	-.50
7	-.33	-.06	.62	-.28	-.25	-.24	1.00	-.32	-.24	-.51	.08	.82
8	.24	-.07	-.37	.31	-.26	-.15	-.32	1.00	-.18	.76	-.23	-.07
9	.76	-.22	.16	-.39	.94	-.21	-.24	-.18	1.00	-.20	-.28	-.18
10	.31	.04	-.65	.51	-.20	.17	-.51	.76	-.20	1.00	-.21	-.30
11	-.39	.68	-.07	.16	-.27	.80	.08	-.23	-.28	-.21	1.00	-.28
12	-.24	-.21	.74	-.28	-.15	-.50	.82	-.07	-.18	-.30	-.28	1.00

TABLE 12

Correlations Among Factor Loadings of Four Factors Based on the Third-Order Partial Correlation Matrix and on the Zero-Order Correlation Matrix for 1813 Head Start Children

	Third-Order Partial				Zero-Order			
	1	2	3	4	5	6	7	8
1	1.00	-.20	-.28	-.18	.18	-.21	.17	.67
2	-.20	1.00	-.21	-.30	.18	.45	-.22	-.36
3	-.28	-.21	1.00	-.28	.08	.35	-.10	-.28
4	-.18	-.30	-.28	1.00	-.05	-.37	.28	.22
5	.18	.18	08	-.05	1.00	-.47	-.21	-.11
6	-.21	.45	.35	-.37	-.47	1.00	-.14	-.08
7	.17	-.22	-.10	.28	-.21	-.14	1.00	-.17
8	.67	-.36	-.28	.22	-.11	-.08	-.17	1.00

TABLE 13

Correlations Among Four Sets of Third-Order Partial Factors: Five Factors and Four Factors for 1813 Head Start Children, and Five Factors and Four Factors for 250 Hawaiian Children in Grades 1 and 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.00	-.17	-.20	-.13	-.16	.99	-.16	-.31	-.18	.44	-.06	-.22	.16	.24	.52	-.05	-.18	.03
2	-.17	1.00	-.15	-.26	-.22	-.21	1.00	-.25	-.28	-.04	-.26	.39	.01	.01	-.05	-.27	.33	.06
3	-.20	-.15	1.00	-.21	-.18	-.23	-.10	92	-.31	-.06	-.11	.03	.39	.06	.02	-.17	.07	.30
4	-.13	-.26	-.21	1.00	-.18	-.18	-.27	-.27	.97	-.12	-.02	.00	-.13	.19	-.04	-.01	.11	-.09
5	-.16	-.22	-.18	-.18	1.00	.00	-.26	.20	.04	.05	.37	-.14	-.12	-.21	-.06	.39	-.19	-.08
6	.99	-.21	-.23	-.18	.00	1.00	-.20	-.28	-.18	.45	.01	-.24	.14	.20	.52	.02	-.22	.02
7	-.16	1.00	-.10	-.27	-.26	-.20	1.00	-.21	-.30	-.03	-.28	.39	.04	.02	-.04	-.30	.34	.07
8	-.31	-.25	.92	-.27	.20	-.28	-.21	1.00	-.28	-.07	.04	-.02	.33	-.03	-.04	-.01	-.01	.26
9	-.18	-.28	-.31	.97	.04	-.18	-.30	-.28	1.00	-.12	.06	-.02	-.18	.13	-.06	.08	.07	-.12
10	.44	-.04	-.06	-.12	.05	.45	-.03	-.07	-.12	1.00	-.05	-.19	-.02	-.02	.91	.07	-.39	-.07
11	-.06	-.26	-.11	-.02	.37	.01	-.28	.04	.06	-.05	1.00	-.20	-.17	-.11	-.15	.95	-.11	-.22
12	-.22	.39	.03	.00	-.14	-.24	.39	-.02	-.02	-.19	-.20	1.00	-.08	-.07	-.22	-.27	.87	-.10
13	.16	.01	.39	-.13	-.12	.14	.04	.33	-.18	-.02	-.17	-.08	1.00	-.08	.04	-.30	-.08	.83
14	.24	.01	.06	.19	-.21	.20	.02	-.03	.13	-.02	-.11	-.07	-.08	1.00	.37	-.23	.36	-.36
15	.52	-.05	.02	-.04	-.06	.52	-.04	-.04	-.06	.91	-.15	-.22	.04	.37	1.00	-.08	-.24	-.13
16	-.05	-.27	-.17	-.01	.39	.02	-.30	-.01	.08	.07	.95	-.27	-.30	-.23	-.08	1.00	-.26	-.20
17	-.18	.33	.07	.11	-.19	-.22	.34	-.01	.07	-.39	-.11	.87	-.08	.36	-.24	-.26	1.00	-.21
18	.03	.06	.30	-.09	-.08	.02	.07	.26	-.12	-.07	-.22	-.10	.83	-.36	-.13	-.20	-.21	1.00

TABLE 14

Correlations Among Loadings on Five Partialled Factors for the First Half, Second Half, and Total Sample of 2313 Cases, Including 2063 Head Start Children and 250 Hawaiian Children in Grades 1 and 2

	First Half					Second Half					Total				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1.00	-.15	-.20	-.24	-.15	.76	-.17	-.11	-.23	.13	.95	-.16	-.17	-.04	-.24
2	-.15	1.00	-.17	-.20	-.03	.08	-.35	.08	.71	-.02	-.11	.95	-.05	-.17	-.17
3	-.20	-.17	1.00	-.23	-.13	-.08	.63	-.10	-.07	-.29	-.13	-.16	-.19	-.20	.92
4	-.24	-.20	-.23	1.00	-.16	-.07	.12	-.07	-.32	.29	-.25	-.26	.03	.82	-.18
5	-.15	-.03	-.13	-.16	1.00	-.26	-.02	.67	.19	-.14	-.16	.02	.91	-.32	-.07
6	.76	.08	-.08	-.07	-.26	1.00	-.22	-.16	-.10	-.17	.88	.06	-.30	-.04	-.14
7	-.17	-.35	.63	.12	-.02	-.22	1.00	-.18	-.20	-.20	-.20	-.39	-.05	.12	.84
8	-.11	.08	-.10	-.07	.67	-.16	-.18	1.00	-.09	-.17	-.11	-.01	.86	-.25	-.13
9	-.23	.71	-.07	-.32	.19	-.10	-.20	-.09	1.00	-.13	-.21	.86	.01	-.35	-.05
10	.13	-.02	-.29	.29	-.14	-.17	-.20	-.17	-.13	1.00	-.02	.00	-.10	.63	-.35
11	.95	-.11	-.13	-.25	-.16	.88	-.20	-.11	-.21	-.02	1.00	-.13	-.19	-.15	-.19
12	-.16	.95	-.16	-.26	.02	.06	-.39	-.01	.86	.00	-.13	1.00	-.08	-.20	-.19
13	-.17	-.05	-.19	.03	.91	-.30	-.05	.86	.01	-.10	-.19	-.08	1.00	-.19	-.16
14	-.04	-.17	-.20	.82	-.32	-.04	.12	-.25	-.35	.63	-.15	-.20	-.19	1.00	-.18
15	-.24	-.17	.92	-.18	-.07	-.14	.84	-.13	-.05	-.35	-.19	-.19	-.16	-.18	1.00

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